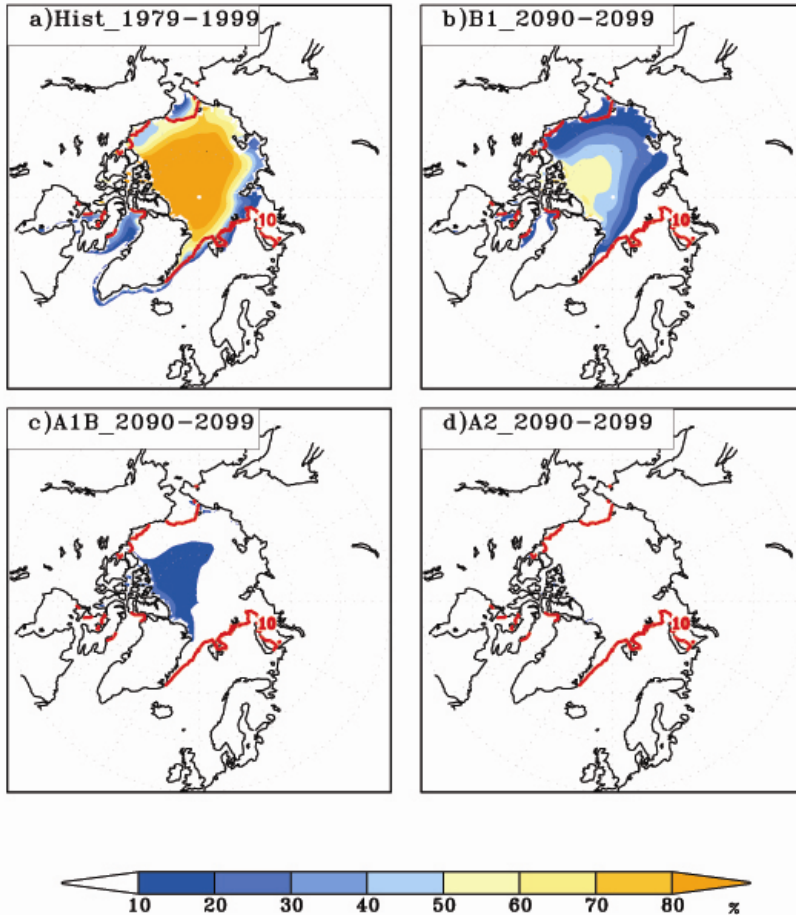


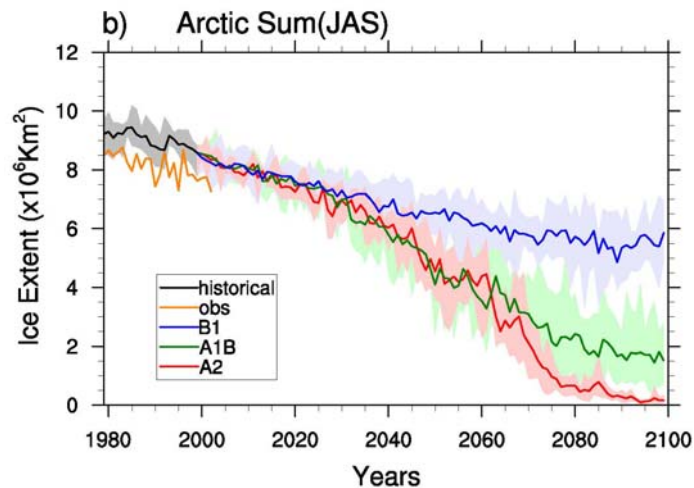
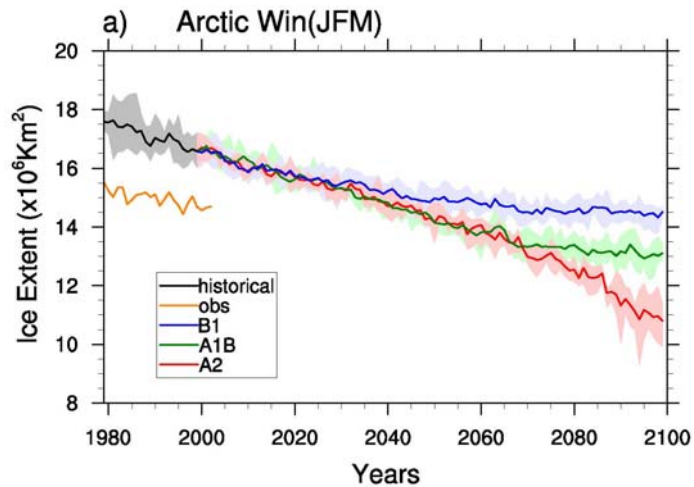
# Arctic Climate Change Projections for the 21<sup>st</sup> Century



Multi-member ensemble mean wintertime sea ice concentration averaged in the periods a) 1979-1999 from the CCSM3 historical runs, b) 2090-2099 from B1 scenario, c) 2090-2099 from A1B scenario, and d) 2090-2099 from A2 scenario. The thick line indicates the 10% contour derived from 1979-1999 satellite observations.

Arctic climate change in the twenty-first century is simulated by the Community Climate System Model version 3.0 (CCSM3) under three emission scenarios (A2, A1B and B1). The model produces a reasonable present-day climate and historical trend. Eight (A1B and B1 scenarios) or five (A2 scenario) ensemble members have been carried out for the 21st-century simulations. They project a decline of sea ice extent in the range of 1.4-3.9% per decade and 4.8-22.2% per decade in the boreal winter and summer, respectively, corresponding to the lower-to-higher anthropogenic forcings. At the end of the 21st century, the winter and summer Arctic mean surface air temperature increases in a range of 4-14°C and 0.7-5°C respectively, compared with the end of the 20th century. The Arctic becomes ice-free in the summers at the end of the 21st century under A2 scenario.

Similar to the observations, the Arctic Oscillation (AO) is the dominant factor in explaining the year-to-year change in the atmosphere and sea ice in CCSM3 historical runs. Yet in the 21st-century simulations, the leading principal mode is associated with the anthropogenic forcing and the AO plays a secondary role in the interannual variations over the Arctic region.



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10.1007/s00382-005-0099-z.

Northern hemisphere sea  
ice extent in a) JFM and b)  
JAS. Solid lines are  
ensemble means, and  
shading indicates the  
range of ensemble  
members. Line identifiers  
for the various scenarios  
and the observations are  
given in each panel.